

CLAIMS

What is claimed is:

1. A photoresist comprising
 - a.) a polymer functionalized with at least one hydroxy ester functional group of the formula:

$$\text{-CO}_2\text{-C(R}^1\text{)(R}^2\text{)-[C(R}^3\text{)(R}^4\text{)]}_n\text{-C(R}^5\text{)(R}^6\text{)-OH,}$$
 wherein
 - n = 0, 1, 2, 3, 4 or 5;
 - R¹, R² = C₁ – C₆ alkyl, C₁ – C₆ alkyl substituted with an ether oxygen; or R¹ and R² taken together form a 3- to 8-membered ring, optionally substituted with an ether oxygen, provided that the carbon attached to R¹ and R² is not at a bridgehead position;
 - R³, R⁴ = H, C₁ – C₆ alkyl, C₁ – C₆ alkyl substituted with an ether oxygen; or R³ and R⁴ taken together form a 3- to 8-membered ring, optionally substituted with an ether oxygen;
 - R⁵, R⁶ = H, C₁ – C₆ alkyl, or C₁ – C₆ alkyl substituted with an ether oxygen; or R⁵ and R⁶ taken together form a 3- to 8-membered ring, optionally substituted with an ether oxygen; or R¹ and R⁵ taken together with $\text{-[C(R}^3\text{)(R}^4\text{)]}_n\text{-}$ form a 4- to 8-membered ring, provided that the carbon attached to R¹ and R² is not at a bridgehead position; and
 - b.) a photoactive component.
2. The photoresist of Claim 1, wherein said polymer further comprises a fluoroalcohol group or a protected fluoroalcohol group.
3. The photoresist of Claim 2, wherein the fluoroalcohol group or protected fluoroalcohol group is derived from at least one ethylenically unsaturated compound containing a fluoroalcohol group having the structure, $\text{-C(R}_f\text{)(R}'_f\text{)OH}$, wherein R_f and R'_f are the same or different fluoroalkyl groups of from 1 to about 10 carbon atoms, or taken together are (CF₂)_n, wherein n is 2 to 10.
4. The photoresist of Claim 3, wherein R_f and R'_f are CF₃.
5. The photoresist of Claim 1, wherein the hydroxy ester functional group is either PinAc or PinMAc.
6. A photoresist comprising
 - a.) a polymer comprising at least one repeat unit derived from $\text{H}_2\text{C=C(X)-CO}_2\text{-C(R}^1\text{)(R}^2\text{)-[C(R}^3\text{)(R}^4\text{)]}_n\text{-C(R}^5\text{)(R}^6\text{)-OH}$ wherein X = H, C₁-C₆ alkyl, F, or F-substituted C₁-C₆ alkyl;

n = 0, 1, 2, 3, 4 or 5;

R¹, R² = C₁ – C₆ alkyl, C₁ – C₆ alkyl substituted with an ether oxygen; or R¹ and R² taken together form a 3- to 8-membered ring, optionally substituted with an ether oxygen, provided that the carbon attached to R¹ and R² is not at a bridgehead position;

R³, R⁴ = H, C₁ – C₆ alkyl, C₁ – C₆ alkyl substituted with an ether oxygen; or R³ and R⁴ taken together form a 3- to 8-membered ring, optionally substituted with an ether oxygen;

R⁵, R⁶ = H, C₁ – C₆ alkyl, or C₁ – C₆ alkyl substituted with an ether oxygen; or R⁵ and R⁶ taken together form a 3- to 8-membered ring, optionally substituted with an ether oxygen; or R¹ and R⁵ taken together with $-[C(R^3)(R^4)]_n-$ form a 4- to 8-membered ring, provided that the carbon attached to R¹ and R² is not at a bridgehead position; and

b.) a photoactive component.

7. The photoresist of Claim 6, wherein said polymer further comprises a repeat unit derived from an ethylenically unsaturated compound which contains at least one fluorine atom covalently attached to an ethylenically unsaturated carbon atom.

8. The photoresist of Claim 7, wherein the ethylenically unsaturated compound is selected from the group consisting of tetrafluoroethylene, chlorotrifluoroethylene, hexafluoropropylene, trifluoroethylene, vinylidene fluoride, vinyl fluoride, perfluoro-(2,2-dimethyl-1,3-dioxole), perfluoro-(2-methylene-4-methyl-1,3-dioxolane, $CF_2=CFO(CF_2)_tCF=CF_2$, where t is 1 or 2, and $R_fOCF=CF_2$, wherein R_f is a saturated fluoroalkyl group of from 1 to about 10 carbon atoms.

9. The photoresist of Claim 6, wherein said polymer further comprises a repeat unit derived from a polycyclic ethylenically unsaturated compound.

10. The photoresist of Claim 9, wherein the polycyclic ethylenically unsaturated compound is selected from the group consisting of

wherein

$n = 0, 1, 2, 3, 4$ or 5 ;

$R^1, R^2 = C_1 - C_6$ alkyl, $C_1 - C_6$ alkyl substituted with an ether oxygen; or R^1 and R^2 taken together form a 3- to 8-membered ring, optionally substituted with an ether oxygen, provided that the carbon attached to R^1 and R^2 is not at a bridgehead position;

$R^3, R^4 = H, C_1 - C_6$ alkyl, $C_1 - C_6$ alkyl substituted with an ether oxygen; or R^3 and R^4 taken together form a 3- to 8-membered ring, optionally substituted with an ether oxygen; $R^5, R^6 = H, C_1 - C_6$ alkyl, or $C_1 - C_6$ alkyl substituted with an ether oxygen; or R^5 and R^6 taken together form a 3- to 8-membered ring, optionally substituted with an ether oxygen; or R^1 and R^5 taken together with $-[C(R^3)(R^4)]_n-$ form a 4- to 8-membered ring, provided that the carbon attached to R^1 and R^2 is not at a bridgehead position;

- b.) a repeat unit derived from a polycyclic ethylenically unsaturated compound; and
- c.) a repeat unit derived from an ethylenically unsaturated compound which contains at least one fluorine atom covalently attached to an ethylenically unsaturated carbon atom.

15. The copolymer of Claim 14, wherein the ethylenically unsaturated compound of (c) is selected from the group consisting of tetrafluoroethylene, chlorotrifluoroethylene, hexafluoropropylene, trifluoroethylene, vinylidene fluoride, vinyl fluoride, perfluoro-(2,2-dimethyl-1,3-dioxole), perfluoro-(2-methylene-4-methyl-1,3-dioxolane, $CF_2=CFO(CF_2)_tCF=CF_2$, where t is 1 or 2, and $R_f'OCF=CF_2$, wherein R_f' is a saturated fluoroalkyl group of from 1 to about 10 carbon atoms.

16. The copolymer of Claim 15, wherein the ethylenically unsaturated compound is tetrafluoroethylene.

17. The copolymer of Claim 14, wherein the polycyclic ethylenically unsaturated compound is selected from the group consisting of

5 R⁵, R⁶ = H, C₁ – C₆ alkyl, or C₁ – C₆ alkyl substituted with an ether oxygen; or R⁵ and R⁶ taken together form a 3- to 8-membered ring, optionally substituted with an ether oxygen; or R¹ and R⁵ taken together with $-[C(R^3)(R^4)]_n-$ form a 4- to 8-membered ring, provided that the carbon attached to R¹ and R² is not at a bridgehead position;

10 ii.) a repeat unit derived from at least one polycyclic ethylenically unsaturated compound; and
iii.) a repeat unit derived from at least one ethylenically unsaturated compound which contains at least one fluorine atom covalently attached to an ethylenically unsaturated carbon atom; and

b.) a photoactive component.

15 19. The photoresist composition of Claim 18, wherein the photoactive component is a photoacid generator.

20. The photoresist composition of Claim 18, further comprising a dissolution inhibitor.

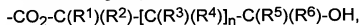
21. The photoresist composition of Claim 18, further comprising a solvent.

20 22. The photoresist composition of Claim 21, wherein the solvent is chosen from the group consisting of ether esters, ketones, esters, glycol ethers, unsubstituted and substituted hydrocarbons, aromatic hydrocarbons, fluorinated solvents and supercritical CO₂.

25 23. The photoresist composition of Claim 18, further comprising at least one additive selected from the group consisting of bases, surfactants, resolution enhancers, adhesion promoters, residue reducers, coating aids, plasticizers, and T_g (glass transition temperature) modifiers.

24. A process for preparing a photoresist image on a substrate comprising, in order:

30 (W) coating a substrate with a photoresist composition, wherein the photoresist composition comprises:
a.) a polymer functionalized with at least one hydroxy ester functional group of the formula:



35 wherein

n = 0, 1, 2, 3, 4 or 5;

R¹, R² = C₁ – C₆ alkyl, C₁ – C₆ alkyl substituted with an ether oxygen; or R¹ and R² taken together form a 3- to 8-

- membered ring, optionally substituted with an ether oxygen, provided that the carbon attached to R¹ and R² is not at a bridgehead position;
R³, R⁴ = H, C₁ – C₆ alkyl, C₁ – C₆ alkyl substituted with an ether oxygen; or R³ and R⁴ taken together form a 3- to 8-membered ring, optionally substituted with an ether oxygen;
R⁵, R⁶ = H, C₁ – C₆ alkyl, or C₁ – C₆ alkyl substituted with an ether oxygen; or R⁵ and R⁶ taken together form a 3- to 8-membered ring, optionally substituted with an ether oxygen; or R¹ and R⁵ taken together with -[C(R³)(R⁴)]_n- form a 4- to 8-membered ring, provided that the carbon attached to R¹ and R² is not at a bridgehead position;
b.) at least one photoactive component; and
c.) a solvent;
- (X) drying the coated photoresist composition to substantially remove the solvent and thereby to form a photoresist layer on the substrate;
- (Y) imagewise exposing the photoresist layer to form imaged and non-imaged areas; and
- (Z) developing the exposed photoresist layer having imaged and non-imaged areas to form the relief image on the substrate.
25. A coated substrate comprising
- a.) a substrate; and
- b.) the photoresist of Claim 18.
26. The coated substrate of Claim 25, wherein the substrate is selected from the group consisting of silicon, silicon oxide, silicon oxynitride, and silicon nitride.